## Supplementary Table 2. Key NBS practices in agriculture and their primary function(s)

Here, ++ and + denote more and less demonstrated secondary functions and (+) a possibility to select species that further contribute to the function.

|  | | **NBS typology** | | | | | | | | | | | **Literature review** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sustainable practices | | | Green infrastructure | | | Bioremediation | | | Conservation | | Key references  \*) added after the literature search |
| Demonstrable essential primary function | | Must have a productive element | | | Must have a structural engineering function | | | Must have a beneficial biochemical, biological or microbial function | | | Must have a species preservation benefit | |
| Generic | Practice | 1.1 production | 1.2 nutrients | 1.3 microclimate | 2.1 water flows | 2.2 soil erosion | 2.3 stabilise slopes | 3.1 pollutants | 3.2 biota | 3.3 carbon sequestration | 4.1 biological diversity (field) | 4.2 connectivity (landscape) |
| Agriculture | Inter-cropping with legumes | + | ++ |  |  |  |  |  |  |  |  |  | (Iverson et al., 2014)\* |
| Irrigated agriculture | Irrigation systems with smart water management systems | ++ |  |  | + |  |  | + |  |  |  | (+) |  |
| Agroforestry | Alley cropping with legumes and/or trees | + | ++ |  |  | ++ | ++ |  |  | + |  |  | (McIvor et al., 2017; Wolz and DeLucia, 2018)  Reference database for tree selection (ICRAF, 2021)\* |
| Silvo-pastoral systems for livestock husbandry | + | + | + |  | + | + |  |  | + |  |  | (Chandler et al., 2018) |
| Silvo-arable systems for cultivation; intercropping | ++ | (+) | + |  | ++ | + |  |  | ++ |  |  | (Golosov and Belyaev, 2013; Zhu et al., 2019) |
| Silviculture | Reduced impact logging | ++ |  |  |  | + |  |  |  | + |  |  | (Hoque Mozumder et al., 2018) |
| Continuous forest cover | ++ |  |  |  | + | + |  | + | + | + |  | (Angelstam and Lazdinis, 2017) |
| Native species plantations | + | + | + | + | ++ |  | (+) |  | (+) | (+) | (+) | (Chu et al., 2019) |
| Aquaculture | Multi-trophic aquaculture | + | ++ |  |  |  |  | ++ |  |  |  |  | (d'Oultremont and Gutierrez, 2002; Li et al., 2019) |
| Agri-/ Aquaculture | Faunal-aquatic systems | ++ | + |  |  |  |  |  |  |  | + |  | (Mohanty et al., 2009)\* |
| Horti-/ Aquaculture | Silvo-aquatic systems | ++ | + |  |  | + |  |  |  |  |  | + | (Rahman and Mahmud, 2018) |
| Soil conser-vation | Cover crops | (+) | + | + |  | (+) |  |  |  |  |  |  | (Daryanto et al., 2018) |
| Contour planting |  |  |  |  | + |  |  |  |  |  |  |  |
| Conservation tillage |  | + |  |  | + |  |  |  | + |  |  | (Singh et al., 2019) |
| Planted grass strips | (+) | + |  | + | ++ |  | + | (+) |  |  |  | (Are et al., 2018; Huang et al., 2019; Lenka et al., 2017; Sinore et al., 2018) |
| Planted brush structures | (+) |  |  |  | ++ | ++ |  | (+) |  |  |  | (Ebabu et al., 2019) |
| Trees or shrubs planted principally for soil conservation purposes |  |  |  |  |  | ++ |  |  | + | (+) | (+) |  |
| Hedgerows;  live fences | (+) |  |  | ++ |  |  |  | (+) |  |  | (+) | (Gatto et al., 2019; Holden et al., 2019) |
| Terracing made with living plants forming a key structural element | (+) | (+) |  | (+) | + |  |  |  |  |  |  | (Zuazo et al., 2011) |
| Sloping agricultural land technology (SALT) | + |  |  | ++ | ++ |  |  |  |  |  |  |  |
| Geotextiles made from straw and bamboo (with contour planting) | + |  | (+) |  | + | ++ |  |  |  |  |  | (Bhattacharyya et al., 2012) |
| Fallow land with active management interventions |  | ++ |  |  |  |  |  |  |  |  |  |  |
| Mulching; crop residue incorporation |  | ++ |  |  |  |  |  |  |  |  |  | (Are et al., 2018) |
| Nurse plants in productive plantations |  |  | + |  |  |  |  |  |  | + |  | (Lu et al., 2018) |
| Water harvesting systems of collectors, drains, sinks and storage ponds; field trenches; planted pits | ++ |  | + | (+) | `(+) |  |  |  |  |  |  | (Mishra and Mohanty, 2004)\* |
| Soil conser-vation | Shelterbelts as wind breaks |  |  | ++ |  |  |  | ++ |  | + |  | + | (Xie et al., 2018) |
| Encouraged bioturbation |  |  |  |  |  |  | ++ |  |  |  |  | (Hoang et al., 2018) |
| Amelioration | Phytoremediation of soil conditions | (+) | (+) |  |  | (+) |  | ++ |  |  |  |  | (Zhang et al., 2019) |
| Phytoremediation of water quality |  |  |  |  |  |  | ++ |  |  |  |  | (Gikas et al., 2018) |
| Buffer zones |  |  |  |  |  |  | ++ |  |  |  | + | (Aguiar Jr et al., 2015; Anbumozhi et al., 2005) |
| Denitrifying bioreactors that use woodchips or other organic processes |  |  |  |  |  |  | ++ |  | + |  |  | (Hassanpour et al., 2019; Sarris and Burbery, 2018; Woli et al., 2010) |
| Pollutant bioremediation |  |  |  |  |  |  | ++ |  |  |  |  | (Hassanpour et al., 2019; Quintella et al., 2019; Sharma et al., 2018) |
| Vegetation filter strips / grass buffer strips |  |  |  | + | + |  | + |  |  |  |  | (Gene et al., 2019) |
| Vegetated drainage ditch |  |  |  | + | + |  | + |  |  |  |  | (Vymazal and Březinová, 2015) |
| Wetlands | Constructed reed beds and cleaning pond systems |  |  |  |  |  |  | ++ |  |  |  |  |  |
| Constructed wetlands |  |  |  |  |  |  | ++ |  |  |  | + | (Chapman, 2012; Gikas et al., 2018; Lee et al., 2014) |
| Water treatment wetlands |  |  |  |  |  |  | ++ |  |  |  |  |  |
| Riparian wetland management; buffer zones | + |  |  | (+) |  |  | + |  |  |  | + | (Anbumozhi et al., 2005; Li et al., 2019; Mander et al., 2017; Wang et al., 2018) |
| Ponds for sediment collection |  |  |  | + |  |  |  |  |  |  |  | (Mtibaa et al., 2018) |
| Vegetated swales |  |  |  | + | ++ |  |  |  |  |  |  | (Gene et al., 2019) |
| Ponds for water treatment |  |  |  |  |  |  | ++ |  |  |  |  | (Jia et al., 2019) |
| Wetlands for ecological diversification |  |  |  |  |  |  |  |  |  |  | ++ |  |
| Ponds for ecological diversification |  |  |  |  |  |  |  |  |  | + |  |  |
| Floodplain designated storage area |  |  |  | ++ |  |  |  |  |  |  |  |  |
| Re-connected / reconstructed floodplain |  | + |  |  |  |  | ++ |  | + | + |  | (Schilling et al., 2017; Sgouridis et al., 2011) |
| Riparian forest |  |  |  |  |  |  |  |  | ++ | + | + | (Angelstam and Lazdinis, 2017; Turunen et al., 2019) |
| Mangrove forest planting | + |  |  | ++ |  |  |  |  | ++ |  |  | (Dat and Yoshino, 2013; Hoque Mozumder et al., 2018) |
| Biodiversity conser-vation | Protected areas |  |  |  |  |  |  |  |  | + | ++ | ++ |  |
| Remnant forest / grassland / wetland patches; ecological focus areas |  |  |  |  |  |  |  |  | + | ++ |  |  |
| Multifunctional land use with conservation provision | + |  |  | ++ | + |  |  |  | + | ++ | ++ | (Mtibaa et al., 2018) |
| Wildflower verges or other pollinator habitat | + |  |  |  |  |  |  | ++ |  | ++ |  | (Ganser et al., 2019) |
| Agro-biodiversity: use of varied provenances of seed or livestock | + |  |  |  |  |  |  |  |  | ++ |  |  |
| Beneficial predator species introduction (pest control) | ++ |  |  |  |  |  |  | ++ |  | ++ |  | (Rosas-Ramos et al., 2018)  Database on crop protection (CABI, 2021)\* |

## References

Aguiar Jr, T. R., Rasera, K., Parron, L. M., Brito, A. G., and Ferreira, M. T. (2015). Nutrient removal effectiveness by riparian buffer zones in rural temperate watersheds: The impact of no-till crops practices. *Agricultural Water Management* **149**, 74-80.

Anbumozhi, V., Radhakrishnan, J., and Yamaji, E. (2005). Impact of riparian buffer zones on water quality and associated management considerations. *Ecological Engineering* **24**, 517-523.

Angelstam, P., and Lazdinis, M. (2017). Tall herb sites as a guide for planning, maintenance and engineering of riparian continuous forest cover. *Ecological Engineering* **103**, 470-477.

Are, K. S., Oshunsanya, S. O., and Oluwatosin, G. A. (2018). Changes in soil physical health indicators of an eroded land as influenced by integrated use of narrow grass strips and mulch. *Soil and Tillage Research* **184**, 269-280.

Bhattacharyya, R., Yi, Z., Yongmei, L., Li, T., Panomtaranichagul, M., Peukrai, S., Thu, D. C., Cuong, T. H., Toan, T. T., Jankauskas, B., Jankauskiene, G., Fullen, M. A., Subedi, M., and Booth, C. A. (2012). Effects of biological geotextiles on aboveground biomass production in selected agro-ecosystems. *Field Crops Research* **126**, 23-36.

CABI (2021). CABI Crop Protection Compendium Vol. 2021. CAB International <https://www.cabi.org/cpc>

Chandler, K. R., Stevens, C. J., Binley, A., and Keith, A. M. (2018). Influence of tree species and forest land use on soil hydraulic conductivity and implications for surface runoff generation. *Geoderma* **310**, 120-127.

Chapman, P. M. (2012). Management of coastal lagoons under climate change. *Estuarine, Coastal and Shelf Science* **110**, 32-35.

Chu, S., Ouyang, J., Liao, D., Zhou, Y., Liu, S., Shen, D., Wei, X., and Zeng, S. (2019). Effects of enriched planting of native tree species on surface water flow, sediment, and nutrient losses in a Eucalyptus plantation forest in southern China. *Science of The Total Environment* **675**, 224-234.

d'Oultremont, T., and Gutierrez, A. (2002). A multitrophic model of a rice-ﬁsh agroecosystem: II. Linking the ﬂooded rice-ﬁshpond systems. *Ecological Modelling* **155** 159-176.

Daryanto, S., Fu, B., Wang, L., Jacinthe, P.-A., and Zhao, W. (2018). Quantitative synthesis on the ecosystem services of cover crops. *Earth-Science Reviews* **185**, 357-373.

Dat, P. T., and Yoshino, K. (2013). Comparing Mangrove Forest Management in Hai Phong City, Vietnam towards Sustainable Aquaculture. *Procedia Environmental Sciences* **17**, 109-118.

Ebabu, K., Tsunekawa, A., Haregeweyn, N., Adgo, E., Meshesha, D. T., Aklog, D., Masunaga, T., Tsubo, M., Sultan, D., Fenta, A. A., and Yibeltal, M. (2019). Effects of land use and sustainable land management practices on runoff and soil loss in the Upper Blue Nile basin, Ethiopia. *Science of The Total Environment* **648**, 1462-1475.

Ganser, D., Knop, E., and Albrecht, M. (2019). Sown wildflower strips as overwintering habitat for arthropods: Effective measure or ecological trap? *Agriculture, Ecosystems & Environment* **275**, 123-131.

Gatto, P., Mozzato, D., and Defrancesco, E. (2019). Analysing the role of factors affecting farmers’ decisions to continue with agri-environmental schemes from a temporal perspective. *Environmental Science & Policy* **92**, 237-244.

Gene, S. M., Hoekstra, P. F., Hannam, C., White, M., Truman, C., Hanson, M. L., and Prosser, R. S. (2019). The role of vegetated buffers in agriculture and their regulation across Canada and the United States. *Journal of Environmental Management* **243**, 12-21.

Gikas, G. D., Pérez-Villanueva, M., Tsioras, M., Alexoudis, C., Pérez-Rojas, G., Masís-Mora, M., Lizano-Fallas, V., Rodríguez-Rodríguez, C. E., Vryzas, Z., and Tsihrintzis, V. A. (2018). Low-cost approaches for the removal of terbuthylazine from agricultural wastewater: Constructed wetlands and biopurification system. *Chemical Engineering Journal* **335**, 647-656.

Golosov, V., and Belyaev, V. (2013). The history and assessment of effectiveness of soil erosion control measures deployed in Russia. *International Soil and Water Conservation Research* **1**, 26-35.

Hassanpour, B., Geohring, L. D., Klein, A. R., Giri, S., Aristilde, L., and Steenhuis, T. S. (2019). Application of denitrifying bioreactors for the removal of atrazine in agricultural drainage water. *Journal of Environmental Management* **239**, 48-56.

Hoang, T. K., Probst, A., Orange, D., Gilbert, F., Elger, A., Kallerhoff, J., Laurent, F., Bassil, S., Duong, T. T., and Gerino, M. (2018). Bioturbation effects on bioaccumulation of cadmium in the wetland plant Typha latifolia: A nature-based experiment. *Science of The Total Environment* **618**, 1284-1297.

Holden, J., Grayson, R. P., Berdeni, D., Bird, S., Chapman, P. J., Edmondson, J. L., Firbank, L. G., Helgason, T., Hodson, M. E., Hunt, S. F. P., Jones, D. T., Lappage, M. G., Marshall-Harries, E., Nelson, M., Prendergast-Miller, M., Shaw, H., Wade, R. N., and Leake, J. R. (2019). The role of hedgerows in soil functioning within agricultural landscapes. *Agriculture, Ecosystems & Environment* **273**, 1-12.

Hoque Mozumder, M. M., Shamsuzzaman, M. M., Rashed-Un-Nabi, M., and Karim, E. (2018). Social-ecological dynamics of the small scale fisheries in Sundarban Mangrove Forest, Bangladesh. *Aquaculture and Fisheries* **3**, 38-49.

Huang, Z., Oshunsanya, S. O., Li, Y., Yu, H., and Are, K. S. (2019). Vetiver grass hedgerows significantly trap P but little N from sloping land: Evidenced from a 10-year field observation. *Agriculture, Ecosystems & Environment* **281**, 72-80.

ICRAF (2021). Global Tree Knowledge Platform. Vol. 2021. World Agroforestry <https://worldagroforestry.org/tree-knowledge>, Nairobi.

Iverson, A. L., Marın, L. E., Ennis , K. K., Gonthier, D. J., Connor-Barrie, B. T., Remfert , J. L., Cardinale, B. J., and Perfecto, I. (2014). Do polycultures promote win-wins or trade-offs in agricultural ecosystem services? A meta-analysis. *Journal of Applied Ecology* **51**, 1593-1602.

Jia, Z., Chen, C., Luo, W., Zou, J., Wu, W., Xu, M., and Tang, Y. (2019). Hydraulic conditions affect pollutant removal efficiency in distributed ditches and ponds in agricultural landscapes. *Science of The Total Environment* **649**, 712-721.

Lee, S., Maniquiz-Redillas, M. C., Choi, J., and Kim, L.-H. (2014). Nitrogen mass balance in a constructed wetland treating piggery wastewater effluent. *Journal of Environmental Sciences* **26**, 1260-1266.

Lenka, N. K., Satapathy, K. K., Lal, R., Singh, R. K., Singh, N. A. K., Agrawal, P. K., Choudhury, P., and Rathore, A. (2017). Weed strip management for minimizing soil erosion and enhancing productivity in the sloping lands of north-eastern India. *Soil and Tillage Research* **170**, 104-113.

Li, M., Callier, M. D., Blancheton, J.-P., Galès, A., Nahon, S., Triplet, S., Geoffroy, T., Menniti, C., Fouilland, E., and Roque d'orbcastel, E. (2019). Bioremediation of fishpond effluent and production of microalgae for an oyster farm in an innovative recirculating integrated multi-trophic aquaculture system. *Aquaculture* **504**, 314-325.

Lu, R., Zheng, J., Jia, C., Liu, Y., Huang, Z., He, H., Han, F., and Wu, G.-L. (2018). Nurse effects of patch-canopy microhabitats promote herbs community establishment in sandy land. *Ecological Engineering* **118**, 126-133.

Mander, Ü., Tournebize, J., Sauvage, S., and Sánchez-Perez, J. M. (2017). Wetlands and buffer zones in watershed management. *Ecological Engineering* **103**, 289-295.

McIvor, I., Youjun, H., Daoping, L., Eyles, G., and Pu, Z. (2017). Agroforestry: Conservation Trees and Erosion Prevention☆. *In* "Reference Module in Food Science". Elsevier.

Mishra, A., and Mohanty, R. (2004). Productivity enhancement through rice–ﬁsh farming using a two-stage rainwater conservation technique. *Agricultural Water Management* **67**, 119-131.

Mohanty, R. K., Jena, S. K., Thakur, A. K., and Patil, D. U. (2009). Impact of high-density stocking and selective harvesting on yield and water productivity of deepwater rice-fish systems. *Agricultural Water Management* **96**, 1844-1850.

Mtibaa, S., Hotta, N., and Irie, M. (2018). Analysis of the efficacy and cost-effectiveness of best management practices for controlling sediment yield: A case study of the Joumine watershed, Tunisia. *Science of The Total Environment* **616-617**, 1-16.

Quintella, C. M., Mata, A. M. T., and Lima, L. C. P. (2019). Overview of bioremediation with technology assessment and emphasis on fungal bioremediation of oil contaminated soils. *Journal of Environmental Management* **241**, 156-166.

Rahman, M. M., and Mahmud, M. A. (2018). Economic feasibility of mangrove restoration in the Southeastern Coast of Bangladesh. *Ocean & Coastal Management* **161**, 211-221.

Rosas-Ramos, N., Baños-Picón, L., Tobajas, E., de Paz, V., Tormos, J., and Asís, J. D. (2018). Value of ecological infrastructure diversity in the maintenance of spider assemblages: A case study of Mediterranean vineyard agroecosystems. *Agriculture, Ecosystems & Environment* **265**, 244-253.

Sarris, T. S., and Burbery, L. F. (2018). Stochastic multi-objective performance optimization of an in-stream woodchip denitrifying bioreactor. *Ecological Engineering* **124**, 38-50.

Schilling, K. E., Kult, K., Wilke, K., Streeter, M., and Vogelgesang, J. (2017). Nitrate reduction in a reconstructed floodplain oxbow fed by tile drainage. *Ecological Engineering* **102**, 98-107.

Sgouridis, F., Heppell, C. M., Wharton, G., Lansdown, K., and Trimmer, M. (2011). Denitrification and dissimilatory nitrate reduction to ammonium (DNRA) in a temperate re-connected floodplain. *Water Research* **45**, 4909-4922.

Sharma, B., Dangi, A. K., and Shukla, P. (2018). Contemporary enzyme based technologies for bioremediation: A review. *Journal of Environmental Management* **210**, 10-22.

Singh, R. J., Deshwal, J. S., Sharma, N. K., Ghosh, B. N., and Bhattacharyya, R. (2019). Effects of conservation tillage based agro-geo-textiles on resource conservation in sloping croplands of Indian Himalayan Region. *Soil and Tillage Research* **191**, 37-47.

Sinore, T., Kissi, E., and Aticho, A. (2018). The effects of biological soil conservation practices and community perception toward these practices in the Lemo District of Southern Ethiopia. *International Soil and Water Conservation Research* **6**, 123-130.

Turunen, J., Markkula, J., Rajakallio, M., and Aroviita, J. (2019). Riparian forests mitigate harmful ecological effects of agricultural diffuse pollution in medium-sized streams. *Science of The Total Environment* **649**, 495-503.

Vymazal, J., and Březinová, T. (2015). The use of constructed wetlands for removal of pesticides from agricultural runoff and drainage: A review. *Environment International* **75**, 11-20.

Wang, Y., Hu, Y., Yang, C., and Chen, Y. (2018). Effects of vegetation types on water-extracted soil organic matter (WSOM) from riparian wetland and its impacts on riverine water quality: Implications for riparian wetland management. *Science of The Total Environment* **628-629**, 1249-1257.

Woli, K. P., David, M. B., Cooke, R. A., McIsaac, G. F., and Mitchell, C. A. (2010). Nitrogen balance in and export from agricultural fields associated with controlled drainage systems and denitrifying bioreactors. *Ecological Engineering* **36**, 1558-1566.

Wolz, K. J., and DeLucia, E. H. (2018). Alley cropping: Global patterns of species composition and function. *Agriculture, Ecosystems & Environment* **252**, 61-68.

Xie, H., Wang, G. G., and Yu, M. (2018). Ecosystem multifunctionality is highly related to the shelterbelt structure and plant species diversity in mixed shelterbelts of eastern China. *Global Ecology and Conservation* **16**, e00470.

Zhang, M., Wang, J., Bai, S. H., Zhang, Y., Teng, Y., and Xu, Z. (2019). Assisted phytoremediation of a co-contaminated soil with biochar amendment: Contaminant removals and bacterial community properties. *Geoderma* **348**, 115-123.

Zhu, X., Chen, C., Wu, J., Yang, J., Zhang, W., Zou, X., Liu, W., and Jiang, X. (2019). Can intercrops improve soil water infiltrability and preferential flow in rubber-based agroforestry system? *Soil and Tillage Research* **191**, 327-339.

Zuazo, V. H. D., Pleguezuelo, C. R. R., Peinado, F. J. M., de Graaff, J., Martínez, J. R. F., and Flanagan, D. C. (2011). Environmental impact of introducing plant covers in the taluses of terraces: Implications for mitigating agricultural soil erosion and runoff. *CATENA* **84**, 79-88.